

What is claimed is:

Sub a1
1. A method for a user to program a personal software agent using an agent manager, wherein said agent manager is connected to an input device for receiving instructions from the user, comprising the steps of:
creating a rule;
placing said rule in an hierarchical order;
determining whether said rule is valid within said hierarchical order;
suggesting repairs to said rule if said rule is invalid.

2. The method described in claim 1, wherein the user creates said rule by defining conditions, attributes and actions of said rule.

3. The method described in claim 2, wherein said hierarchical order is comprised of parent rules, child rules, sibling rules, and inter rules.

4. The method described in claim 3, wherein said rule is placed in said hierarchical order using CLASSIC.

Sub a2
5. The method described in claim 4, wherein said rule inherits actions from said parent rules, wherein said child rules inherits actions from said rule, and said

- 1 inter rules inherits actions from the intersection of
- 2 said rule and said sibling rules.

- 1 6. The method described in claim 5, wherein CLASSIC
- 2 determines subsumption relations among rules.

- 1 7. The method described in claim 6, wherein CLASSIC
- 2 determines intersections among rules.

1 8. The method described in claim 7, wherein said
2 action is defined in terms of preconditions, add list
3 and delete list for said action.

1 9. The method described in claim 8, wherein said rule
2 is repaired using an interactive dialogue explaining why
3 said action does not apply and suggesting repairs to
4 said rule that will enable said actions.

1 10. The method described in claim 9, wherein said
2 invalid rule is categorized according to why said rule
3 is invalid.

1 11. The method described in claim 10, wherein repairs
2 applied to said invalid rule are applied to rules in the
3 same category as said invalid rule.

1 12. An agent manager for a personal software agent, the
2 agent manager having an input device for receiving
3 instructions from a user, comprising:
4 rule edit module having a rule edit input coupled
5 to the input device for receiving instructions from the
6 user for creating a rule, and having a rule edit output;
7 rule index module having a rule index input coupled
8 to said rule edit output for receiving said rule and
9 placing said rule in hierarchical order, and having a
10 rule index output;

1 rule analysis module having a rule analysis input
2 coupled to said rule index output for receiving said
3 hierarchical order and using said hierarchical order for
4 determining whether said rule is valid, and having a
5 rule analysis output; and
6 rule repair module having a rule repair input
7 coupled to said rule analysis output to receive said
8 rule if said rule is invalid in order to guide the user
9 in selecting and applying repairs to make the rule
10 valid.

1 13. The agent manager described in claim 12, wherein
2 said rule edit module allows the user to enter
3 conditions, attributes and actions to define said rule.

1 14. The agent manager described in claim 13, wherein
2 said hierarchical order is comprised of parent rules,
3 child rules, sibling rules, and inter rules.

1 15. The agent manager described in claim 14, wherein
2 said rule index module permits the user to create
3 structured descriptions of sets of objects and
4 individual objects.

1 16. The agent manager described in claim 15, wherein
2 said rule index module represents said rule using
3 CLASSIC..

Sub Q4

1 17. The agent manager described in claim 16, wherein
2 said rule index module inherits actions from said parent
3 rules to said rule, inherits actions from said rule to
4 said child rules, and inherits actions from the
5 intersection of said rule and said sibling rules to said
6 inter rules.

1 18. The agent manager described in claim 17, wherein
2 said rule index module determines subsumption relations
3 among rules.

1 19. The agent manager described in claim 18, wherein
2 said rule index module determines intersections among
3 rules.

1 20. The agent manager described in claim 19, wherein
2 said action is defined in terms of preconditions, add
3 list and delete list for said action.

1 21. The agent manager described in claim 20, wherein
2 said rule repair module creates an interactive dialogue
3 explaining why said action does not apply and suggests
4 repairs to said rule that will enable said actions.

1 22. The agent manager described in claim 21, wherein
2 said rule repair module categorizes invalid plans

36

1 according to why said plans are invalid.

1 23. The agent manager described in claim 22, wherein
2 said rule repair module applies said repairs to rules in
3 the same category as said invalid rule.

Sub 25
1 24. Apparatus for automatically verifying whether a new
2 rule which is to be added to a set of rules is valid
3 with respect to the set of rules, each rule specifying a
4 set of conditions and a sequence of actions being
5 interpreted in a system which causes the actions
6 specified in the rule to be performed when the
7 conditions specified in the rule are satisfied, the
8 apparatus comprising:
9 a stored subsumption hierarchy of the rules in the
10 set of rules;
11 means for placing the new rule in the subsumption
12 hierarchy; and
13 means for using the subsumption hierarchy which
14 includes the new rule to determine whether the rule is
15 valid and provide an indication of invalidity when the
16 rule is not valid.

1 25. The apparatus described in claim 24, wherein the
2 means for using the subsumption hierarchy further uses
3 the subsumption hierarchy to determine a suggested
4 correction for the new rule when the new rule is not

~~5 valid and provide the suggested correction.~~

25 26. The apparatus described in claim 25, further
2 comprising means responsive to an input from a user of
3 the apparatus indicating acceptance of the suggested
4 correction for correcting the new rule according to the
5 suggested correction.

Sub Q6
1 27. The apparatus described in claim 26, wherein the
2 means for using the subsumption hierarchy determines
3 whether the rule is valid by using the subsumption
4 hierarchy to determine whether the conditions of the new
5 rule and another rule of the set of rules can apply
6 simultaneously and if the conditions do so apply,
7 analyzing the actions of the rules for conflicts.

27 28. The apparatus described in claim 27, wherein the
9 means for using the subsumption hierarchy determines
10 whether the conditions of the new rule and another rule
11 can apply simultaneously by using the subsumption
12 hierarchy to determine whether the condition of one of
13 the rules is more general than the condition of the
14 other or whether the condition of one of the rules
15 intersects with the condition of the other of the rules.

28 29. The apparatus described in claim 28, wherein the
1 means for using the subsumption hierarchy further uses

1 the subsumption hierarchy to determine a category for a
2 suggested correction which has been accepted and find
3 other rules which require corrections belonging to the
4 category.

1 ²⁹~~30~~ The apparatus described in claim ²⁹~~29~~, wherein the
2 means for placing the new rule in the subsumption
3 hierarchy does so each time the new rule is altered.

Sub Q7.
1 31. Interactive rule editing apparatus for editing a
2 rule which is to be added to a set thereof, each rule
3 specifying a condition and an action and being
4 interpreted in a system which causes the action
5 specified in the rule to be performed when the condition
6 specified in the rule is satisfied, the interactive rule
7 editing apparatus comprising:
8 input means;
9 output means;
10 means for determining whether the rule to be added
11 is valid with regard to the set thereof and if the rule
12 to be added is not valid, providing a suggested
13 correction;
14 means for altering the rule; and wherein
15 the input means receives the rule to be added
16 and provides the rule to be added to the means for
17 determining;
18 the output means receives the suggested

19 correction and outputs the suggested correction;
20 the input means receives an indication that
21 the suggested correction has been accepted; and
22 the means for altering the rule responds to
23 the indication by altering the rule to be added in
24 accordance with the suggested correction.